

Claims

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A system for monitoring the conditions within a fuel storage compartment of a transport tank, said system comprising:
 - a probe adapted to be installed in a fuel storage compartment and having a first sensor for detecting the presence of fuel at a predetermined level therein, and a second sensor for detecting the pressure of a gaseous head above the fuel,
 - a signal generator responsive to said first and second sensors for producing a first signal representing a normal condition when the first sensor is not detecting fuel at said predetermined level, a second signal when said second sensor detects a predetermined high pressure of the gaseous head, and a third signal when said second sensor detects a predetermined low pressure of the gaseous head, and
 - an output control responsive to said signals for delivering as output said first signal when said second and third signals are not present, and for delivering as output said second signal when said second signal is received or said third signal when said third signal is received, whereby to indicate a condition precluding delivery of fuel to or from the compartment whenever either a predetermined high or low pressure condition is present.
2. The system as set forth in claim 1 wherein said first signal is a periodic waveform.

3. The system as set forth in claim 2 wherein said second signal is a periodic waveform having a period greater than said first signal.
4. The system as set forth in claim 3 wherein said third signal is a periodic waveform having a period greater than said second signal.
5. The system as set forth in claim 1 wherein said predetermined high pressure is approximately 3-4 psi above normal pressure.
6. The system as set forth in claim 1 wherein said predetermined low pressure is approximately 1 psi below normal pressure.
7. The system as set forth in claim 1 further comprising a retain/overflow monitor coupled to said output control and responsive to said signals from said output control to selectively output a permit signal to enable transfer of fuel to or from said transport tank.
8. The system as set forth in claim 7 wherein said retain/overflow monitor outputs said permit signal when said first signal is received from said output control.

9. The system as set forth in claim 8 wherein said retain/overflow monitor ceases output of said permit signal when said second signal is received from said output control.

10. The system as set forth in claim 9 wherein said retain/overflow monitor includes a display panel having indicators responsive to said first and second signals for providing an overflow and/or a high pressure detected display.

11. The system as set forth in claim 10 wherein said indicators present an audible alarm in response to said second signal.

12. The system as set forth in claim 8 wherein said retain/overflow monitor ceases output of said permit signal when said third signal is received from said output control.

13. The system as set forth in claim 12 wherein said retain/overflow monitor includes a display having an indicator responsive to said third signal for presenting a low pressure detected display.

14. The system as claimed in claim 13 wherein said indicator presents an audible alarm in response to said third signal.

15. The system as set forth in claim 7 wherein said retain/overflow monitor includes a display panel having indicators for displaying the operational status of the system.

16. The system as set forth in claim 15 wherein said indicators present a normal system display in response to said first signal in the absence of said second and third signals.

17. The system as set forth in claim 7 further comprising at least two of said probes and said signal generators and a detector responsive to a short circuit between said at least two probes to cause said retain/overflow monitor to disable output of said permit signal when said short is detected.

18. The system as set forth in claim 17 wherein said detector compares the output signals from each of said at least two signal generators for a predetermined number of simultaneous transitions which indicate a short between said at least two probes.

19. A system for monitoring the conditions within a fuel storage compartment of a transport tank, said system comprising:

- a probe adapted to be installed in a fuel storage compartment and having a first sensor for detecting the presence of fuel at a predetermined level therein, and a second sensor for detecting the pressure of a gaseous head above the fuel,
- a signal generator responsive to said first and second sensors for producing a normal waveform when the first sensor is not detecting fuel at said predetermined level, a pressure waveform when said second sensor detects a predetermined high pressure of the gaseous head, and a vacuum waveform when said second sensor detects a predetermined low pressure of the gaseous head, and
- an output control responsive to said waveforms for delivering as output said normal waveform when said pressure and vacuum waveforms are not received, and for delivering as output exclusively said pressure waveform or said vacuum waveform when either are received, whereby to indicate a condition precluding delivery of fuel to or from the compartment whenever either a high or low pressure condition is present.

20. The system as set forth in claim 19 wherein said normal waveform is periodic.

21. The system as set forth in claim 20 wherein said pressure waveform is periodic and has a period of different duration than said normal waveform.

22. The system as set forth in claim 21 wherein said vacuum waveform is periodic and has a period of different duration than said normal and pressure waveforms.

23. The system as set forth in claim 19 wherein said predetermined high pressure is approximately 3-4 psi above normal pressure.

24. The system as set forth in claim 19 wherein said predetermined low pressure is approximately 1 psi below normal pressure.

25. The system as set forth in claim 19 further comprising a retain/overflow monitor coupled to said output control and responsive to said signals from said output control to selectively output a permit signal to enable transfer of fuel to or from said transport tank.

26. The system as set forth in claim 25 wherein said retain/overflow monitor outputs said permit signal when said normal waveform is received from said output control.

27. The system as set forth in claim 26 wherein said retain/overflow monitor ceases output of said permit signal when said pressure waveform is received from said output control.

28. The system as set forth in claim 27 wherein said retain/overflow monitor includes a display panel having indicators responsive to said normal and pressure waveforms for providing an overflow and/or a high pressure detected display.

29. The system as set forth in claim 28 wherein said indicators present an audible alarm in response to said pressure waveform.

30. The system as set forth in claim 26 wherein said retain/overflow monitor ceases output of said permit signal when said vacuum waveform is received from said output control.

31. The system as set forth in claim 30 wherein said retain/overflow monitor includes a display having an indicator responsive to said vacuum waveform for presenting a low pressure detected display.

32. The system as claimed in claim 31 wherein said indicator presents an audible alarm in response to vacuum waveform.

33. The system as set forth in claim 25 wherein said retain/overflow monitor includes a display panel having indicators for displaying the operational status of the system.

34. The system as set forth in claim 33 wherein said indicators present a normal system display in response to said normal waveform in the absence of said pressure and vacuum waveforms.

35. The system as set forth in claim 25 further comprising at least two of said probes and at least two signal generators and a detector responsive to a short circuit between said at least two probes to cause said retain/overflow monitor to disable output of said permit signal when said short is detected.

36. The system as set forth in claim 35 wherein said detector compares the output signals from each of said at least two signal generators for a predetermined number of simultaneous transitions which indicate a short between said at least two probes.

37. A method of monitoring the conditions within a fuel storage compartment of a transport tank, said method comprising the steps of:

- (a) detecting the presence of fuel at a predetermined level in said compartment,
- (b) detecting the pressure of a gaseous head above the fuel in said compartment,
- (c) generating a first signal when fuel is not detected at said predetermined level,
- (d) generating a second signal when the gaseous head has a predetermined, excessively high pressure,
- (e) generating a third signal when the gaseous head has an excessively low pressure,
- (f) delivering as output said first signal when said second and third signals are not produced, and
- (g) delivering as output exclusively said second signal or said third signal when either are produced, whereby to indicate a condition precluding delivery of fuel to or from the compartment whenever excessively high or low pressure conditions are present.

38. The method as set forth in claim 37, further comprising the step of:

- (h) monitoring said output signals and providing a permit signal in response to said first signal to enable transfer of fuel to or from said transport tank.

39. The method as set forth in claim 38 wherein said step (h) includes ceasing to provide said permit signal in response to said second signal.

40. The method as set forth in claim 38 wherein said step (h) includes ceasing to provide said permit signal in response to said third signal.